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ABSTRACT

In 1984, summer bridge students in the Indiana University Learning Skills Center were asked to complete an open-ended questionnaire on PLATO computer assisted instruction (CAI) used in their study skills courses. Of 226 students responding to the survey, 175 (77%) had chosen to use PLATO; 86 students used both the psychology and sociology review lessons, while 49 used only the former and 35 only the latter. The remaining students used only lessons which were not directly related to the study skills program, e.g., math or English language lessons. Students used PLATO for a variety of reasons, i.e., convinced by instructors, attracted to the computer format, persuaded by friends, reduction of study time, better understanding of course materials, or to gain experience on a computer. Although trained neither in computer science nor in evaluation of education programs, the students identified each of four requisites for success identified in literature discussing CAI effectiveness: (1) implementation must be voluntary; (2) it must be part of a larger, overall educational program and implemented in conjunction with larger educational objectives; (3) the software must take advantage of the computer's interactive capabilities and it must be of pedagogical quality; and (4) the student must not be in primary control of the pacing. It is suggested that students have a wealth of knowledge which educators could and should tap in order to vastly improve the effectiveness of educational programs using computers. A list of references and copy of the student questionnaire are provided. (JB)

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STUDENTS ARE CAPABLE OF ASSESSING THE EFFECTIVENESS OF COMPUTER-ASSISTED INSTRUCTION

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ABSTRACT

Articles discussing the effectiveness of computer-assisted instruction have all too often ignored the perceptions of the students who use the software. Student input has long been an effective means of improving teaching and of evaluating instructional materials. It seems reasonable that student input could similarly be used to evaluate and improve CAI.

In 1984 summer bridge students in the Indiana University Learning Skills Center were asked to complete an open-ended questionnaire on PLATO-CAI used in their study skills course. Although trained neither in computer science nor in evaluation of educational programs, the students identified each of four requisites for success which had been identified in literature discussing CAI effectiveness. The implication is that students have a wealth of knowledge which educators could and should tap in order to vastly improve the effectiveness of educational programs using computers.

STUDENTS ARE CAPABLE OF ASSESSING THE EFFECTIVENESS OF COMPUTER-ASSISTED INSTRUCTION

Through tremendous advances in software, particularly through new authoring systems, mainstream teachers are beginning to produce educational software for their students' use. Although the medium is new, teachers have traditionally produced their own handouts and other supplementary educational materials. Teacher-produced software may be geared more towards individualized instruction than traditional handouts, but other than that its general purpose remains the same.

Once teachers are actively producing CAI and students are using it, they must necessarily determine its effectiveness. The problem is that in assessing CAI there has long been a lack of consensus as to what constitutes effectiveness:

> The effectiveness of CAI has been defined differently by different investigators. To some, effectiveness means the amount of learning that takes place initially. To others it means the degree of retention of learning, or at the very least, whether or not an individual stays in or drops out of a learning experience. Still others are concerned with the learner's change in attitude toward the computer as an instructional medium or simply as a helpful tool in the culture. Finally, owing to the fact that CAI is in its infancy, some

> are simply concerned with transportability of materials and/or acceptance of the materials for use by others (Walker & Hess, 1984, p. 3).

Just as they traditionally provide guidance in evaluating teaching and instructional materials, teacher education programs will at some point provide guidance in determining the effectiveness of CAI. This task should not be nearly as complicated as the computer journals would have us believe. Software is traditional supplementary material in a new medium, so the basic precepts of its evaluation should remain unchanged.

Since computer technology provides a range of interactive features not found in traditional media, and since software is considerably more expensive than traditional media, teachers should not simply be satisfied with effectiveness. If it cannot be shown that CAI is a more effective means of learning, the technology has not been fully tapped and money has been wasted. For these reasons the Indiana University Learning Skills Center has developed appropriate software and implemented CAI in a manner which appears to be consistent with this tougher standard.

By comparing expected and actual scores on psychology and sociology exams, for example, we found that some 200 high risk freshman received statistically significant higher scores in the summer of 1982 because they had chosen to review for the test using PLATO-CAI lessons (Woelffer and Chase, 1983). The lessons had been specifically prepared for use in Indiana

University's summer bridge program. A similar study using data from the 1984 summer course supported the original findings (Luk and Jacobs, 1985). The Learning Skills Center staff was encouraged by the results of this study, but we remained somewhat skeptical in light of other published reports of less favorable results.

We therefore turned our attention to variables which might explain CAI's success in some published studies and its lack of success in others. After researching the literature on this topic, we concluded that there are several requisites for successful CAI: (1) it must be implemented on a voluntary basis, (2) it must be a part of a larger overall educational program, and implemented in conjunction with larger educational objectives, (3) the software must take advantage of the computer's interactive capabilities and it must be of pedagogical quality, and (4) the student must not be in primary control of the pacing (Hartig, 1984). Although the literature presented valid arguments which led to these conclusions, we were puzzled by how little attention the researchers paid to the perceptions of the students who were being studied.

In most cases the studies were limited to objective measures of performance. Sometimes, but not always, they included a student attitude survey. In a few studies student input was more formally solicited, but the resulting information was of little value because the requested information was very basic. We are capable of learning much more about CAI from our students than simply how many students had used

computers before, how many liked a particular CAI lesson, and how many would like to do further study on the computer.

In his study of Journalism CAI at Indiana University, William Oates in 1982 was one of the first to use student input in a more substantive manner. He found that instructors consistently responded more favorably to CAI materials than students. Other researchers have since substantiated this finding. The instructor/student discrepancy in fact seems to hold true for both instructional and motivational values:

> The reported differences between teacher and student evaluations can be attributed to their different roles. Teachers, as content specialists, are more critical of the specific content of a program. Knowledgeable in teaching strategies and the development of the concepts, they are aware of the varying pedagogical complexities for the different topics. Students, not cognizant of these intricacies, evaluate programs on the basis of interest, clarity and their level of participation (Signer, 1983, p. 35).

Offir (1983, p. 28) found that, in regard to educational aims in general and CAI in particular, "...the actual situation in reality is closer to the opinions of the students." If this assertion is true, future research into CAI effectiveness must investigate the great wealth of knowledge held by our students, the true CAI experts.

In the summer of 1984 I wanted to get a clearer picture of the students' potential in software evaluation and design, so I gave our high risk freshmen a rather lengthy questionnaire (see Appendix). These are students who did not meet Indiana University's admissions criterea, but who were admitted on a special summer bridge program upon the recommendation of high school counselors throughout the state. One requirement of the summer program is that the students enroll in a study skills course which in small groups teaches techniques for studying in two large lecture classes: introductory psychology and introductory sociology. Despite the fact these students were not well prepared academically and that they at times lacked motivation, their answers to the questionnaire provide support for Offir's position.

Of 226 students responding to the survey, 175, or 77% had chosen to use PLATO. Eighty-six students used both the psychology and sociology review lessons, while 49 used only the former and 35 only the latter. The remaining students used only lessons which were not directly related to the study skills program, e.g., math or English language lessons. Students used PLATO for a variety of reasons:

78 students were convinced by instructors of PLATO's value,

70 were attracted to the computer format and technology,

68 students were persuaded by students who had previously used PLATO, finding it valuable,

56 thought PLATO could reduce their total study time,

42 felt PLATO would lead to better understanding of the course material,

32 thought PLATO would enable them to do better on the tests, and

4 students said simply that they wanted experience on a computer.

Many students of course checked or wrote in more than one answer to this question (#2 on the survey), thereby confirming that the decision to use or not use CAI can be fairly complex.

The responses to question #7, answered by students who did not use PLATO, were equally varied. These answers, however, fit rather conveniently into three broad categories: (1) students didn't know about PLATO, (2) they intended to use PLATO but never got around to it, or (3) they felt, some correctly and others not, that they were doing OK without it and so preferred not to use it.

As previously mentioned, CAI in the Learning Skills Center has been predominantly voluntary in nature. Research into personality types has shown that certain people simply do not mesh well with computers (Hoffman and Waters, 1982). It would be counterproductive, then, to force these people to use CAI. Without knowledge of this research, our students made very similar comments:

I used PLATO because I was curious about computers. People who aren't curious about

computers shouldn't be required to use it.

PLATO holds my attention because of my interest in computers. Other students might not feel the same way.

I don't like computers. I flunked computers in high school. I don't work well with computers, so I chose not to use PLATO.

I had a frightening experience with computers before, so friends had to work hard to convince me to use it.

On this issue the students are overwhelmingly pro-choice, and in some instances negative feelings would obviously have resulted from mandatory CAI. Not a single student commented that PLATO should have been required.

The aforementioned comments came in response to question #4 on the survey. The appropriateness of CAI as an individual decision is underscored by the objective portion of this question:

65% felt that learning from PLATO was more effective than learning the same materials from books and notes,

30% felt that learning through the various media was "about the same," and

5% felt that PLATO was a less effective means of learning.

The problem for educators is that, depending on the particular student in question, each of these responses may be equally valid.

Just as CAI is best left voluntary, it is also more successful when it is an integral part of a larger educational program (Camstra, van Dijk, van der Avoird, 1979). In other words, CAI cannot stand alone. It must be implemented with a specific learning objective in mind in order to contribute to a larger learning objective. In this vein, too, our students made some perceptive comments:

> Neither CAI nor books can be effective without the other.
>
> Books can be used without PLATO, but PLATO not without books.
>
> Sometimes the textbook and discussion in class was difficult to understand, and PLATO helped a lot. PLATO can't stand alone, though.
>
> PLATO covered the most important material, but it didn't cover everything that was important.
>
> I did OK in class, but only because I relied more on my notes than on PLATO.

The overall goal of the summer program was to prepare students for the coursework they would complete in the coming fall semester and beyond. The students obviously recognized that various components of the overall program worked together to achieve this goal. PLATO was simply one of those components.

The third requisite for success, that CAI must be interactive and of pedagogical quality, seems quite obvious. It is perhaps a reflection on an "educational software" industry which seldom employs educators that much of today's commercial

software cannot be described in these terms. Formal support for interactive CAI has come from various research efforts (e.g., Avner, Moore and Smith, 1980; and Schloss, Schloss and Cartwright, 1984). I anticipated comments from our students in support of interaction, and the students did not let me down:

> PLATO is more effective because books and notes are passive.
>
> PLATO saved me study time. To do the lessons I had to get more involved with the material. I got more involved with studying this term because I got into it.
>
> PLATO gave a better, interactive relationship to work in.
>
> I used PLATO before in another class and knew it could be a better way to learn because it requires you to get actively involved with material.
>
> PLATO could be more effective if it
>
> -- had more content, more examples and more questions
> -- were capable of handling essay answers
> -- generated the terms randomly
> -- gave us the choice of more varied types of things to do.

Interactive software, however, must not proceed at the expense of pedagogical quality (Fisher, 1982). Our students were quick to point this out, too. At least a dozen students

indicated that the psychology and sociology material was presented more clearly on PLATO than in their books and in class, and that it was primarily for this reason that PLATO was a more effective way to learn. In addition, several students mentioned that they had previously been exposed to poor quality software and as a result hadn't learned anything.

The final requisite for successful implementation of CAI is that pacing must be externally controlled (Steinberg, 1977). This would appear to be a most difficult concept for persons with little training in computer science. As might be expected, only one of our 175 PLATO users broached this topic:

> It was good because PLATO led me through the exercises step-by-step and wouldn't let me go on before I was ready.

With this single comment, though, our students as a group had made appropriate mention of each ingredient for successful CAI.

College teachers have long solicited student input at the end of each term on both classroom instruction and instructional materials. While some teachers make little use of their students' evaluations, others know that this data can be valuable in improving their courses in the future. The Learning Skills Center questionnaire indicates that this same approach, if the right questions are asked, can provide a tremendous amount of information which can potentially improve both software design and the use of CAI in our schools. The students' words will not be as eloquent as those of the researchers, and students are not in a position to support

their claims with measurable data. The important point is that our students know a great deal about the appropriateness of instructional tools and how they are used. Instead of assuming that we have little to learn from students about CAI, educators need to take steps to tap the students' knowledge in this area.

In addition to demonstrating the students' expertise in the area of computer-assisted instruction, the 1984 questionnaire showed that students for the most part held PLATO-CAI in high esteem. The responses to question #3 provide perhaps the best support for this assertion. Of 144 respondents, 31% claimed to have spent more time studying because of PLATO. This response was favorable in all but one instance. In open-ended comments students explained that they were more interested in the material because of PLATO, and so spent more time learning. The 55% who spent less time studying because of PLATO also made numerous positive comments. They learned more easily because PLATO explained more clearly and provided better summaries. Thirteen percent of the students felt the amount of study was about the same as it would have been without PLATO, and the remaining 3% were unsure of any effect PLATO may have had on study time.

The overall favorable reaction to PLATO was consistent with our own observation of students during the summer, as well as with the previously mentioned statistical data on test scores. In certain other ways, however, the questionnaire was more a cause for concern than for rejoicing. Despite lengthy

periods of "down time" and numerous reports of terminal malfunction over the course of the summer, an unlikely 94% of the respondents reported that PLATO worked properly when they used it. Only 5% reported that it did not, either part or all of the time. Also despite numerous complaints during the summer, IU's PLATO facilities got a 91% rating of approval. In retrospect it seems the students had a more positive reaction to the facilities than did the instructors. When the students' comments were negative, they generally cited the need for additional terminals.

Even more disturbing, particularly in regard to research, is that at least 15% of the students signed on at one point or another under assumed names. I had learned from several instructors that some students had worked with friends at the PLATO terminals. This activity can be a productive learning experience, but it possibly means that some 25 additional students with lower-than-expected test scores did use PLATO, or vice versa. The explanation most often given for using a friend's sign on was a forgotten password.

It is admittedly not easy to tally the results of open-ended student surveys. It takes considerable time to decipher handwriting and to make sense out of comments. It is also more likely that teachers and administrators will obtain disconcerting results than it is with traditional evaluation forms which are primarily objective in nature. With these caveats in mind, I would very much encourage educators to use this approach when assessing the role of CAI

in their curricula. Little is known about the proper use of CAI in any specific subject area. Open-ended questionnaires, despite their drawbacks, can provide considerable useful information.

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APPENDIX

GROUPS 1984 COMPUTER-ASSISTED INSTRUCTION QUESTIONNAIRE

1. Did you use PLATO lessons this summer in your X152 course?

   ____ yes ____ no

   If no, skip to question #7.

   If so, which lessons did you use?

   ____ Psych Review

   ____ Soc Review

   ____ Other (Please specify: _____

   _____

   Did PLATO work properly for you when you used it?

   ____ yes ____ no ____ unsure

   Did you use your own personal sign-on, or a friend's sign-on?

   ____ my own

   ____ a friend's

2. Why did you use PLATO? (Check as many as appropriate.)

   ____ past students reported PLATO to be valuable for learning X152 material

   ____ my instructor convinced me to use it

   ____ I was attracted to the computer format

   ____ I thought it would reduce the amount of time I spent in reading and homework for X152

   ____ other (please specify): _____

   _____

3. On the whole, would you say you spent more time or less time than you otherwise would have spent learning the X152 material since you did it on PLATO? Explain your answer: _____

_____

_____

_____

_____

4. Check the item which most strongly reflects your opinion.

_____ learning on PLATO is more effective than learning the same material from books and notes

_____ learning on PLATO is about the same as learning the same material from books and notes

_____ learning from PLATO is <u>not</u> as effective as learning the same material from books and notes

Comments: _____

_____

_____

5. How can the PLATO lessons be improved? Include specific suggestions for individual PLATO lessons if you wish.

_____

_____

_____

_____

_____

6. Are the PLATO facilities (LSC, Library, Education Bldg.) adequate for your purposes?

_____ yes _____ no (please explain: _____

_____)

7. If you did not use PLATO, or used it some but not much, please briefly describe why you chose not to do so. _____

_____

_____

_____

_____

_____